GEJ-3816

OPERATING MANUAL

MODEL U25
DIESEL-ELECTRIC
LOCOMOTIVE

GENERAL ELECTRIC

GEJ-3816C

OPERATING MANUAL

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GENERAL ELECTRIC MODEL U25 DIESEL-ELECTRIC LOCOMOTIVE

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

Do not order parts from plates in this publication.

GENERAL ELECTRIC

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GENERAL DATA

MODEL	U25B	U25C
HORSEPOWER	2500	2500
TYPE (AAR SYMBOL)	B-B	C-C
MAJOR DIMENSIONS		
Over-all Length Inside Knuckles	60 ft 2 in.	64 ft 6 in.
Over-all Width	10 ft 7 in.	10 ft 7 in.
Over-all Height Above Rail	14 ft 7 in.	14 ft 10 in.
Length Between Center Plates	36 ft 2 in.	42 ft
Total Wheel Base	45 ft 6 in.	49 ft 10 in.
Truck Wheel Base	9 ft 4 in.	13 ft
DRIVE		
Traction Motors	Four GE-752	Six GE-752
Wheel Diameter	40 in.	40 in.
WEIGHT (TYPICAL)		
Total Weight (With 2900 gal Fuel Tank)	260,000 lb	360,000 lb
Total on Drivers	260,000 lb	360,000 lb
Per Axle	65,000 lb	60,000 lb
SUPPLIES		
Fuel	2900 gal	2900 gal
Lubricating Oil	365 gal	365 gal
Cooling Water	290 gal	290 gal
Governor Oil	2 qt	2 qt
Sand	32 cu ft	32 cu ft
AIR BRAKES	26L	26L

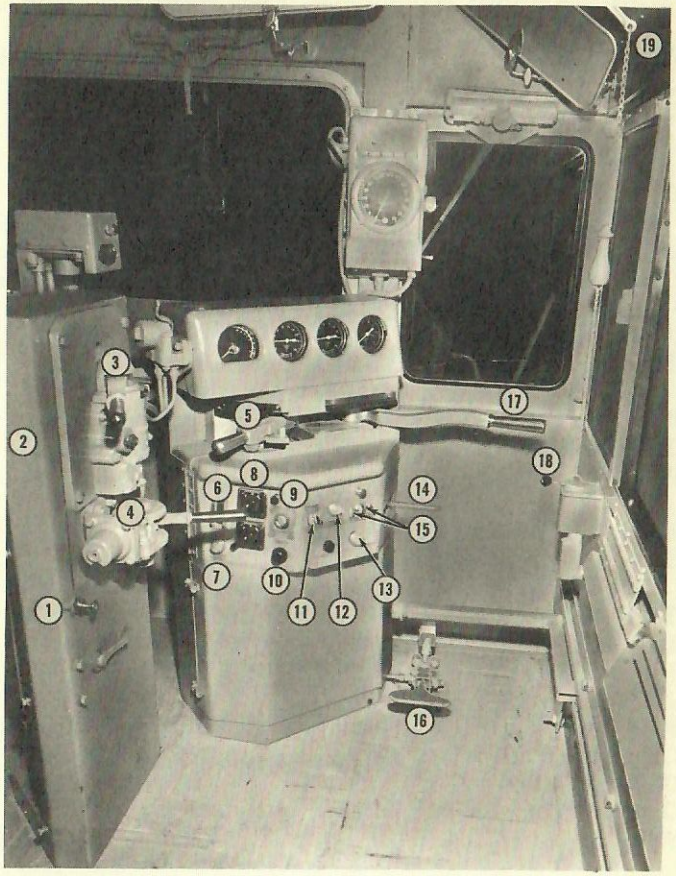


Fig. 1. (E-13034)

1 Bell ringer
2 Air regulating valve (feed valve)
3 Automatic brake valve
4 Independent brake valve
5 Selector handle
6 Generator-field circuit breaker
7 "PCS" open" light
8 Headlight switches
9 Emergency shutdown switch
10 Call button
11 Power limit switch
12 Brake warning light
13 Wheel-slip light
14 Reverse handle
15 Light switches
16 Safety control pedal
17 Throttle handle
18 Sander control
19 Order light and window wiper control (on cab ceiling)

Fig. 1. Engineman's position

INTRODUCTION

All of the operating devices, manual and visual, normally used by the engineman during locomotive operation are located near the operator's position. Most of these devices are located either on the master controller, on the air brake stand, or on the engine control panel.

NOTE: Customer equipment requirements often differ from one railroad to another. Therefore physical locations and appearance of some devices illustrated in this manual may not agree entirely with the equipment furnished to any particular railroad.

MASTER CONTROLLER

The master controller is a set-up switch used by the operator to control the locomotive. It has a throttle handle, a selector handle, and a reverse handle. These handles control motoring and dynamic braking (if used). Various control switches, circuit breakers, and indicating lights are mounted on the housing of the controller.

Mechanical interlocking between the handles prevents improper operation of any handle. (See INTERLOCKING BETWEEN HANDLES.)

THROTTLE HANDLE (See Fig. 1 and 2)

The throttle handle has an IDLE and 8 major and 8 intermediate positions or notches. Major notches are registered by a number. Intermediate notches are registered by a dot or 1/2 mark. This handle controls tractive effort when motoring and braking effort when dynamic braking is being used.

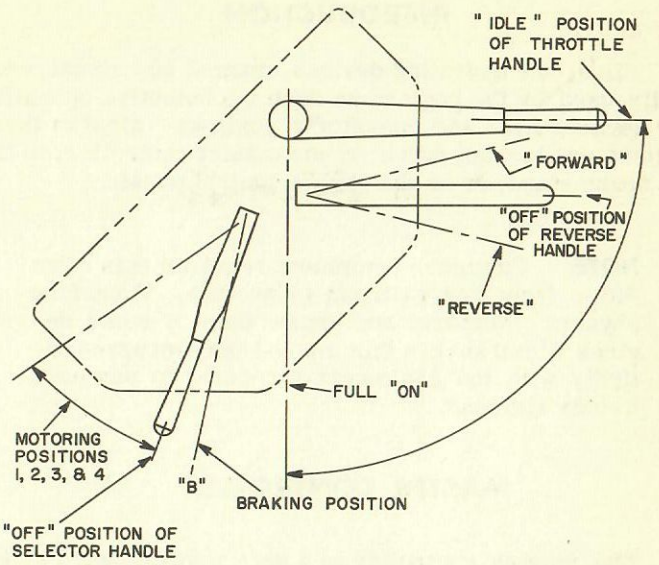


Fig. 2. (E-10102A)

Fig. 2. Master controller handle position

REVERSE HANDLE (See Fig. 1 and 2)

The reverse handle has positions FORWARD, OFF, and REVERSE. It is used to control the direction of locomotive movement.

SELECTOR HANDLE (See Fig. 1 and 2)

The selector handle has positions 4, 3, 2, 1, OFF and B. The numbered positions are used when motoring. Position B is used when in dynamic braking.

In ordinary operation, since all U25 locomotives are equipped with automatic transition, the selector handle may be placed in position 1 during motoring and left there.

Positions 2, 3, and 4 are used to provide transition for any locomotive units which are in multiple operation

and are not equipped with automatic transition. Handle movement is governed by transition speed of other locomotive units in the consist.

INTERLOCKING BETWEEN HANDLES

Interlock between handles of the master controller is governed in the following manner:

1. The reverse handle can be taken out only when in the OFF position. The selector handle must also be in OFF or 1 and the throttle handle in IDLE position.

2. The reverse handle cannot be moved unless the selector handle is in OFF or 1 and throttle handle is in IDLE.

3. The throttle handle cannot be advanced from IDLE unless the selector handle is in 1, 2, 3, 4, or B.

4. The throttle handle can be moved with the reverse handle in any position.

5. The selector handle cannot be moved into B (braking) unless the throttle handle is in IDLE and the reverse handle is in FORWARD or REVERSE.

DEVICES ON MASTER-CONTROLLER HOUSING (See Fig. 1)

The following operating devices are located on the master controller housing:

M.U. Emergency Shutdown Switch

This switch has two positions, STOP and RUN. The normal position is RUN. When this switch is turned to STOP, the diesel engines on all units in multiple unit locomotive consist will shut down.

This switch is provided for emergency use only. Normal shut-down should be made by moving the throttle to

IDLE, engine control switch (EC) to START, and depressing the STOP button on the engine control panel.

After an emergency shut-down, the engine control switch (EC) must be turned to START and engine(s) must be restarted in the normal manner.

Power Limit Switch

This switch has two positions, NORMAL and NOTCH 7. When locomotive units of the same horsepower are operated in the locomotive consist, this switch is ordinarily in NORMAL position.

When the leading unit is slipping excessively, the power limit switch can be moved to notch 7 to reduce power while the trailing units are operating at full power. This will reduce the tractive effort on the leading unit and will usually improve the ability of the locomotive to hold the rail under bad rail conditions.

When other locomotives of lower horsepower ratings are operated in the consist, under certain conditions, this switch must be moved to the NOTCH 7 position unless the locomotives are equipped with automatic power matching control.

Other Switches

a. Front headlight

b. Rear headlight

c. Step lights

d. Gage lights and dimmer control.

Call Button

Call button is used to sound alarm bell in all locomotive units.

Wheel-slip Light

Light indicates when a pair of wheels are slipping.

"PCS OPEN" Light

Light indicates that the PCS switch is open and has not been reset.

Generator-field Circuit Breaker

The generator field circuit breaker is ON whenever the locomotive is powered. The breaker may also be used to keep the main generator de-energized when it is necessary to run the engine at speeds higher than idle.

ENGINE CONTROL PANEL

The engine control (EC) panel is located on the rear wall of the operator's cab (see Fig. 3). Mounted on this panel are various other switches, circuit breakers and operating devices used during locomotive operation.

ENGINE CONTROL SWITCH (See Fig. 3)

The engine control switch has two positions, START and RUN. Engine start button is effective only when the EC switch is in the START position.

When the engine is running and the EC switch is in START position, engine speed is held at idle and power cannot be applied to the locomotive. The power plant is said to be "off the line".

When the engine is idling and the locomotive is to be operated, the engine control switch (EC) must be moved to RUN position.

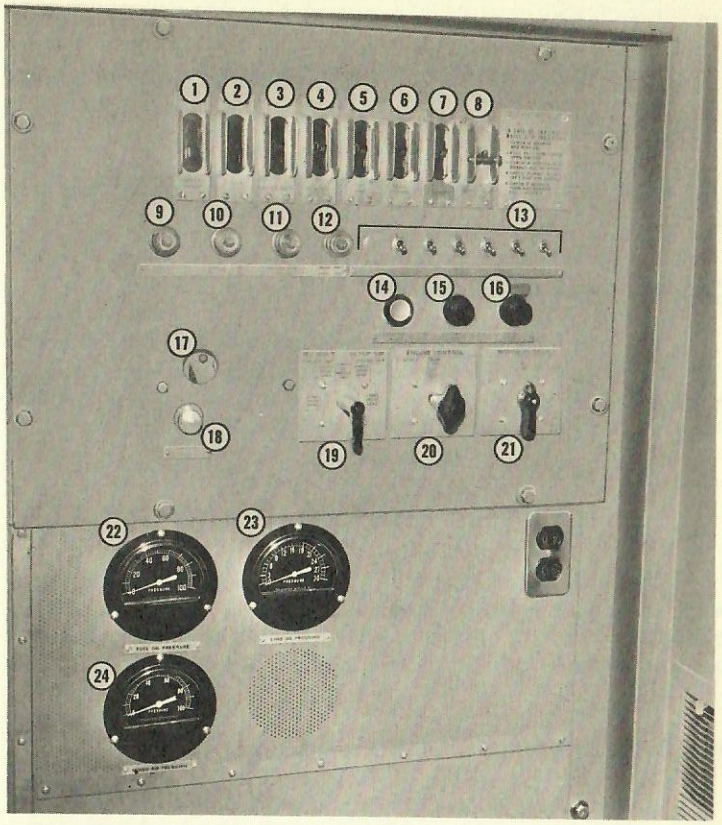


Fig. 3. (E-13027)

1 Battery charging circuit
2 Running lights
3 Headlights
4 Control
5 Fuel pump
6 (Optional equipment)
7 (Optional equipment)
8 Slip-suppression cut-out
9 Hot engine
10 Low oil
11 No battery charge
12 Low water
13 Light switches
14 Fuel pump reset
15 Engine start
16 Engine stop and emergency stop
17 Ground relay trip indicator
18 Ground relay reset
19 M. U. headlight set-up switch
20 Engine control switch
21 Motor cut-out switch (optional)
22 Fuel oil pressure
23 Lube oil pressure
24 Turbo (intake manifold) air pressure

Fig. 3. Engine control panel

ENGINE START AND STOP BUTTONS (See Fig. 3)

To start the diesel engine, depress the ENGINE START button firmly and hold until the engine starts. To stop the engine, depress the STOP button momentarily.

The engine start button is effective only when the engine control switch (EC) is in the START position.

M.U. HEADLIGHT SET-UP SWITCH (See Fig. 4)

The M. U. HEADLIGHT SET-UP SWITCH has five positions. Positioning of this switch is determined by location of the locomotive unit in the consist and whether the front of the locomotive unit is leading or trailing. Switch positions are as follows:

SINGLE OR MIDDLE UNIT Place switch in this position on any locomotive unit operated singly or on all units except the leading or trailing unit, when the locomotive consist is made up of more than one unit.

SHORT HOOD LEAD – LEADING UNIT Place switch in this position when leading unit is operated with the short hood forward.

LONG HOOD LEAD – LEADING UNIT Place switch in this position when leading unit is operated with the long hood forward.

SHORT HOOD TRAIL – TRAILING UNIT Place switch in this position when final trailing unit is connected so its short hood trails.

LONG HOOD TRAIL – TRAILING UNIT Place switch in this position when final trailing locomotive is connected so its long hood trails.

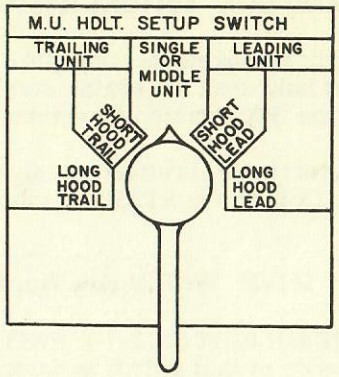


Fig. 4. (E-11960)

Fig. 4. M.U. headlight set-up switch

M.U. BRAKING SELECTOR SWITCH

The M.U. dynamic braking selector switch (when installed) is furnished in several styles depending on the request of a railroad. Position the selector switch according to the directions on the nameplate and according to railroad rules.

The selector switch must be positioned before leaving the terminal and must not be changed even if the engine is isolated enroute.

MOTOR CUT-OUT SWITCH (See Fig. 3)

The motor cutout switch (if installed) can be used to cut out one or more traction motors. At the same time, power output of the locomotive will be reduced. Operation of the motor cutout switch does not eliminate a ground fault in a power circuit.

Under emergency conditions the locomotive may be operated for a short period of time with one or more motors cut out. Refer to railroad rules for specific details of operation.

CIRCUIT BREAKERS ON EC PANEL (See Fig. 3)

The following circuit breakers are located on the engine control panel:

1. Charging Circuit – Isolates battery charging generator from the control system.
2. Running Lights (all lights except headlights)
3. Headlights
4. Control
5. Fuel Pump

SWITCHES ON EC PANEL (See Fig. 3)

The following switches are located on the engine control panel:

1. Hood-Engine-Control Compartment Lights
2. Rear Classification Lights
3. Front Classification Lights
4. Front Number Lights
5. Rear Number Lights
6. M. U. Walkway Lights (if equipped)
7. Slip Suppression Cut Out – Normally this switch is sealed in the "UP" (closed) position. The switch should only be opened as directed by railroad regulations.

GROUND RELAY (See Fig. 3)

The ground relay is furnished to protect the power and control circuits. An indication pointer moves to a red dot and the bell rings when the relay has tripped. The reset button must be pushed to reset the relay.

MISCELLANEOUS CONTROLS

In addition to the afore described operating devices, the following other controls are used by the engineman during locomotive operation.

1. Bell Valve – Mounted on the engineman's brake stand. (See Fig. 1.)

2. Horn Valve – Mounted on the ceiling of the operator's cab. Operated by a pull cord. (See Fig. 1.)

3. Sander Control – Mounted on the right side wall of the engineman's position. (See Fig. 1.)

4. Windshield Wiper Valves – Located on the ceiling over the engineman's and fireman's positions.

5. Hand Brake – Located on outside of nose compartment (low nose locomotive).

6. Fireman's Emergency Valve – Knob located on front left bulkhead in operator's cab. Pulling this knob causes a full emergency brake application and dropping of power.

7. Emergency Fuel Cut-Off System – In an emergency any one of three electric push buttons may be depressed momentarily to cut off fuel delivery and shutdown the engine. One of these buttons is located on each side of the locomotive near the fuel tank. The third button (Engine Stop) is located on the engine control panel and is also used for normally shutting down the engine.

NOTE: The emergency cut-off button is used to shut down the engine on one unit only. The emergency shutdown switch on the master controller is used to shutdown the engines on all units of the consist.

8. Fuel-trip Reset Button – The fuel-trip reset button on the engine control panel must be depressed before depressing the engine start button for engine starting and after an emergency fuel cut-off button has been depressed.

9. Cab Heater – Cab heat is regulated by turning the regulating valves on the lower right side of the cab heater to a desired heat delivery. Adjust louvers on the sides of the heater for suitable air deflection.

CAUTION: TO PREVENT HEATER FROM FREEZING IN COLD WEATHER, LEAVE VALVES OPEN AT ALL TIMES.

10. Window Defrosters – The heat for window defrosting is controlled by the same regulating valve which controls cab heat. Defrosting may be controlled at each window by sliding the multi-hole slide plate at the window frame, as desired.

11. Cab Ventilation – Cab ventilation is controlled by positioning the hand operated lever at the base of the cab heater as desired. During long periods of dynamic braking the lever should be moved to the closed position.

AIR BRAKE EQUIPMENT

The schedule 26-L equipment, arranged for single-end, multiple-unit operation, is used on this locomotive. The principal parts are:

26-C BRAKE VALVE (See Fig. 5)

This brake valve consists of two separate valves; the automatic brake valve and the independent brake valve. The automatic valve is designed for regulating brake-pipe pressure to control both locomotive and train brakes. The independent valve will apply and release locomotive brakes independent of the train brakes. The independent valve also controls the release of the locomotive brakes due to an automatic brake application, without releasing the train brakes.

AUTOMATIC BRAKE VALVE HANDLE (See Fig. 5)

Has six positions:

1. RELEASE (RUNNING) POSITION – This position charges the equipment and releases the locomotive and train brakes after an automatic application. This is accomplished by controlling air flow to the brake pipe as set by handle position of regulating valve (on back of brake stand). This position is at the extreme left of quadrant and is the NORMAL position when the automatic brake is not in use.

2. MINIMUM REDUCTION POSITION – This position is located to the right of the Release position where the brake valve handle reaches the first raised portion of the quadrant. With the brake valve handle moved to this position, a light service application is obtained which results in a 6 to 8 lb. brake pipe reduction.

3. SERVICE POSITION – This position consists of a sector of the brake valve handle movement to the right of

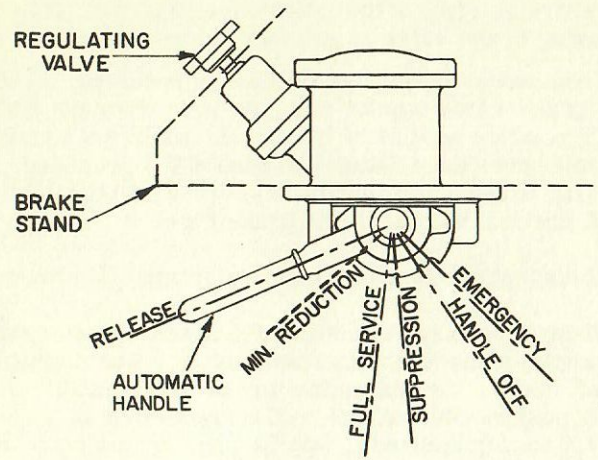


Fig. 5. (E-8924D)

Fig. 5. Automatic brake valve handle positions

the minimum reduction position. Moving the brake valve handle from the left to right of this sector increases the degree of brake application. At the extreme right of the sector a full service brake application is obtained.

4. SUPPRESSION POSITION – This position is located with the handle against the second raised position of the quadrant to the right of the RELEASE position. This position provides a full service brake application as with the brake valve handle in the FULL SERVICE position, but in addition, on locomotive units so equipped, overspeed control and safety control applications are suppressed.

5. HANDLE – OFF POSITION – This position is located by the quadrant notch to the right of the SUPPRESSION position. The handle is removable in this position. It must be placed in this position and removed on trailing units of a multiple-unit locomotive or on locomotive being towed "dead" in a train.

6. EMERGENCY POSITION – This position is located to the extreme right of the brake valve quadrant. It is used for making brake valve emergency brake application.

When an emergency application is received, the automatic brake valve handle must be moved to the EMERGENCY position and left in this position until the equalizing reservoir gage hand indicates zero ("0") pressure. The automatic brake valve handle must then be moved to RELEASE position to charge the brake pipe.

(If equipped with overspeed protection)

When the overspeed control functions, a service brake application is made about 5 sec. after a warning whistle sounds. Leave the automatic brake valve handle in RELEASE position during the initial reduction of approximately 9 lb. for approximately 21 sec. At the start of the second reduction (indicated by a further drop in equalizing reservoir pressure) move the automatic brake valve handle to SUPPRESSION position and leave it in this position until the application gage hand shows not less than 125 lb. pressure, then move automatic brake valve handle to RELEASE position.

INDEPENDENT BRAKE VALVE HANDLE (See Fig. 1)

Applies and releases the brakes on the locomotive unit or releases the brakes on the locomotive unit alone, after an automatic or emergency application.

The independent brake valve has two positions, Release and Full Application, with the application zone in between. The brake valve is of the self-lapping type which automatically laps off the flow of air and maintains brake cylinder pressure when the application pressure reaches the pressure corresponding to the position of the handle. An independent brake application can be released only by movement of the brake valve handle towards release position. An automatic service or emergency application can be released on the locomotive by depressing the independent brake valve handle in release position.

BRAKE VALVE CUT-OUT COCK (See Fig. 6)

This cut-out cock, also known as the double-heading cock, is located on the front of the automatic brake stand. Select position for type of service being used. The cut-out position is used when locomotive unit is operated dead in a train. Push in handle and turn to change positions.

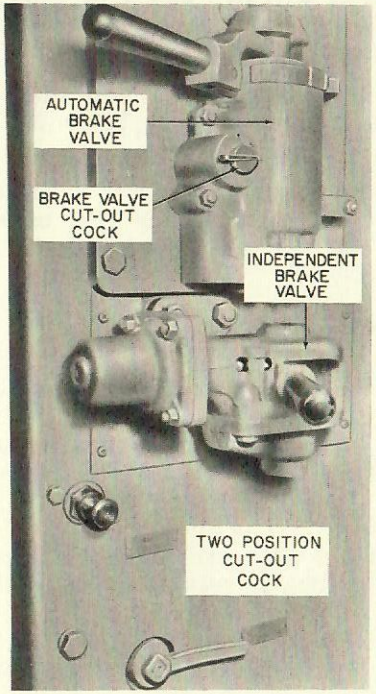


Fig. 6. (E-13035)

Fig. 6. Air brake controls

MU-2A VALVE (EQUIVALENT OF ROTAIR VALVE)

This is a three-position valve located on back of brake console. It is used to enable a locomotive equipped with 26-L brakes to be operated in multiple-unit with locomotives having other type brake equipment.

NOTE: On some railroads this device is replaced by a two-position cut-out cock.

The three positions of the MU-2-A valve are: LEAD or DEAD; TRAIL-6 or 26; and TRAIL-24.

1. LEAD or DEAD position of valve is selected when locomotive unit is operated singly or when it is the lead unit of a multiple-unit consist. Also used when locomotive unit is hauled dead in a train.

2. TRAIL-6 or 26 position is used when locomotive is trailed behind a locomotive having 6SL or 26L brake equipments.

3. TRAIL-24 position is used when locomotive is trailed behind a locomotive having 24RL brake equipment. Push handle in and turn to change positions.

TYPE 26-F CONTROL VALVE

This valve is located in the air brake compartment. When actuated by the automatic brake valve, it operates to charge, apply, and release the brakes on the locomotive. The Release Cap on the control valve can be mounted in two ways:

1. With letters GRA over word RELEASE. This position provides graduated release of automatic brakes.

2. With letters DIR over word RELEASE. This position provides direct release of automatic brakes.

DUPLEX AIR GAGES

The following air gages are located on the gage panel in front of the engineman:

1. Main Reservoir – Equalizing Reservoir – Red hand indicates main reservoir pressure; white hand indicates equalizing reservoir pressure.

2. Brake Cylinder – Brake Pipe – Red hand indicates locomotive brake cylinder pressure; white hand indicates brake pipe pressure.

3. Application-Suppression – Red hand indicates overspeed or safety control "penalty" application; white hand indicates suppression (if this feature is used).

CUT-OUT COCKS

At specified inspection or maintenance periods the following manually operated devices are used:

1. Main Reservoir Cut-out Cock – Located on the right side of the locomotive near the rear main reservoir.

2. Main Reservoir Drain Cocks – One located on the end of each main reservoir.

3. Air-filter Drain Cock – Located near rear end of fuel tank on filter.

4. Control-air Cut-out Cock – Located in air brake compartment.

5. Control-air Reservoir Drain Cock – Located in air brake compartment on left side wall.

6. Brake Cylinder Cut-out Cocks – Located on right side beneath locomotive platform level (one for each truck).

7. Air Compressor Governor Cut-out Cock – Located in air brake compartment.

8. Bell, Horn and Window Wiper Cut-out Cock – Located in air brake compartment.

9. Angle Cocks at Each End of Locomotive (Fig. 8).

a. Brake Pipe

b. Main Reservoir Equalizing

c. Actuating

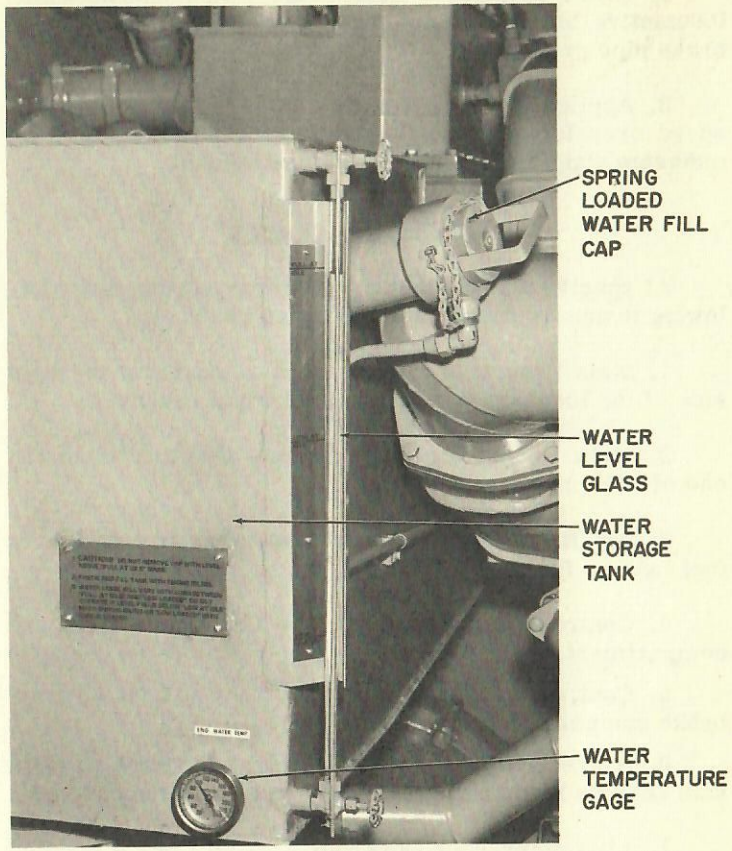


Fig. 7. (E-11825A)

Fig. 7. Water storage tank

d. Brake Cylinder Equalizing (Independent Application and Release)

e. Forward Sand (Pneumatic sanding only) – right side

f. Reverse Sand (Pneumatic sanding only) – left side

10. Safety Control Cut-out Cock – Located in air brake compartment. Cuts out safety control feature when closed.

Fig. 8. (E-11821)

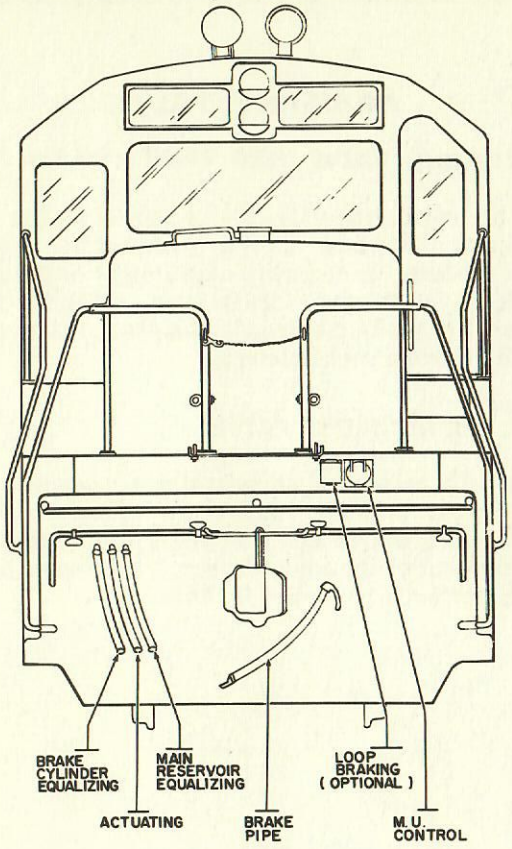


Fig. 8. Locomotive end connections

11. Overspeed Control Cut-out Cock – Located in air brake compartment. Cuts out overspeed control feature when closed.

12. Slip Suppression Cut-out Cock – Located in middle of air brake compartment.

AIR EQUIPMENT

13. Dead Engine Cock – Located in air brake compartment.

ADJUSTING VALVES

AIR REGULATING VALVE (FEED VALVE) (See Fig. 5)

The air regulating valve located on the air brake stand, automatically maintains a predetermined air pressure in the brake system. A clockwise movement of the adjusting handle increases the pressure setting. A counterclockwise movement decreases the pressure setting. (Adjust to conform with railroad regulations.)

CONTROL AIR REDUCING VALVE

This valve maintains a predetermined normal air pressure in the air pressure supply for operation of the reverser, braking switch and pneumatic contactors. Clockwise adjustment of the adjusting screw increases pressure. Normal control air pressure is 70 lb.

AUTOMATIC ALARMS AND SAFEGUARDS

CIRCUIT BREAKERS (See Fig. 3)

1. Operated like a toggle switch to open circuit manually.

2. Overload in a breaker circuit causes breaker to open the circuit automatically and the handle moves into center position indicating breaker has tripped.

3. Breaker is reset by moving to OFF, then to ON, after allowing a few minutes for thermal element in the breaker to cool. The breaker should only be reclosed if there is no visible reason for the automatic opening of the circuit. If it trips after reclosing, it should be left open unless instructed otherwise.

COLORED LIGHTS AND BELLS

During normal locomotive operation, the bell and all colored lights are off. When locomotive consists of more than one unit colored lamps will light on affected unit only. Bell will sound on all units.

NOTE: If troubles occur on two or more units at the same time which cause the alarm bell to ring, turn the EC switch on all affected units to START position before attempting to restart any unit. With the throttle handle on the lead unit beyond IDLE position, it is impossible to start any unit while the alarm bell is ringing.

LOW-OIL AND LOW-WATER LIGHTS (YELLOW) (See Fig. 3)

A yellow light on the Engine Control Panel will light when either the engine lube oil supply or the cooling water pressure is low.

AUTOMATIC ALARMS AND SAFEGUARDS

1. If engine lubricating-oil pressure drops to between 10 to 14 psi at 400 rpm, or between 25 to 30 psi at 1000 rpm the engine shuts down and a yellow LOW-OIL indicating lamp lights. After engine shuts down, the alarm bell will sound as long as the engine control switch (EC) is in the RUN position.

A yellow LOW-WATER indicating lamp will also come on if the water supply is low.

2. After engine shuts down, move EC switch to START to silence the alarm bell. Check lubricating oil supply on dip-stick. Check for broken or cracked oil lines. Also check water supply at storage tank and check for water piping leaks.

3. To restart diesel engine after fault is corrected:

a. Depress shut-down plunger on engine governor until it clicks and stays in.

NOTE: Some engine governors may be equipped with two shutdown plungers, one for low oil and one for low water. Be sure both plungers are reset.

b. Depress engine start button.

c. After the engine is running recheck for signs of distress.

d. If condition is normal put locomotive "on the line" and recheck for signs of distress.

4. If engine fails to start due to LOW-OIL PRESSURE RESET button tripping, do not repeat cranking.

5. If locomotive units are being operated in multiple, then engine on affected unit only, will shut down.

AUTOMATIC ALARMS AND SAFEGUARDS

HOT ENGINE LIGHT (RED) (See Fig. 3)

1. If engine water temperature becomes excessive, the alarm bell sounds and the HOT ENGINE indicating lamp (red) lights. At first opportunity investigate for cause. When cooling water temperature returns to normal, alarm bell will stop ringing. Turning engine control switch (EC) to START will not stop the ringing of alarm bell or turn off the HOT ENGINE light. If cooling water temperature does not return to normal in a reasonable length of time, shut engine down.

NO BATTERY CHARGE (BLUE) (See Fig. 3)

If engine is running and engine control switch (EC) is in RUN position and battery charging equipment fails, then NO BATTERY CHARGE lamp (blue) will light and alarm bell will sound.

GROUND RELAY (See Fig. 3)

1. a. If a ground occurs in the main power circuits, the ground relay operates to reduce engine speed automatically to IDLE, removes power from traction motors, and sounds the alarm bell.

The indicating pointer on the ground relay will point to the red dot on its target. The pointer can be seen through the round window on the plate covering the ground relay which is mounted on engine control panel.

b. If a ground occurs in the control circuits, the ground relay may operate during the engine cranking cycle. Report condition.

2. To reset relay:

a. Take engine "off the line".

b. Push in ground relay reset button on engine control panel.

c. Advance throttle handle. If ground relay stays in, continue normal operation.

NOTE: On locomotives equipped with a trainline ground relay reset, a tripped relay is indicated by a warning light. To reset the relay, return the throttle handle to IDLE. Wait 15 seconds, then press the reset button. The same reset button is pressed and the same resetting procedure applies when a generator overload relay (GOLR) has tripped.

3. If ground relay immediately operates a second time, affected unit must not be operated. Unit must either be shut down or, if necessary, engine can be left running by turning EC switch to START. This takes unit "off the line".

PCS SWITCH

The pneumatic control switch (PCS) is operated from the air brake system.

During a safety control "penalty" or emergency air brake application, this switch opens. Engine speed is reduced to IDLE and power is removed. The "PCS OPEN" ("PC OPEN") light at engineman's position will light.

To reset the PCS switch automatically:

1. Move throttle handle to IDLE.

NOTE: If PCS switch has tripped while in dynamic braking the selector handle must be returned to OFF to reset the circuit.

2. Move automatic brake valve handle to SUPPRESSION.

3. Depress safety control foot pedal (if used). (When application pipe builds up to normal pressure, PCS will reclose.)

4. Move automatic brake valve handle to RELEASE.

WHEEL SLIP

If any wheels slip during locomotive operation, the following occurs:

1. A light brake application and a slight reduction in excitation occurs automatically on the locomotive unit that is slipping.

2. When wheels stop slipping, brake application is removed automatically.

3. If wheels continue to slip for more than 2 or 3 seconds, wheel slip lamp (on master controller stand) lights and sand is automatically applied to the wheels of affected unit only. If slip persists, excitation is gradually reduced automatically.

ENGINE OVERSPEED SHUTDOWN (See Fig. 9)

In the event that the engine overspeeds to 1100 rpm, the engine is shut down automatically. After an overspeed-shut-down of the engine, move EC switch to START. Reset the overspeed mechanism by pushing in the knob of the engine overspeed governor (Fig. 9) located on the left side of the engine under the engine control governor. Proceed to start engine as described under STARTING ENGINE. If it overspeeds again do not restart the engine. If troubles occur on two or more units at the same time which causes the alarm bell to ring, turn the EC switch on all affected units to START position before attempting to restart any unit. With the throttle handle on the lead unit beyond IDLE position, it is impossible to start any unit while the alarm bell is ringing. (During freezing weather protect engine cooling system according to railroad instructions.)

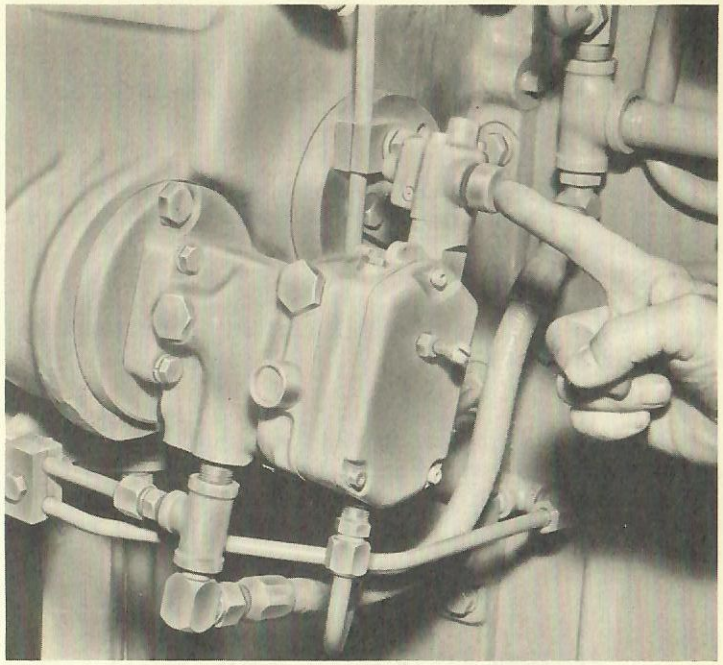


Fig. 9. (E-13028)

Fig. 9. Engine overspeed governor and reset

SAFETY CONTROL FOOT PEDAL (See Fig. 1)

A foot pedal, if equipped, is located at the operator's position. Pedal must be depressed at all times during locomotive operation. If operator's foot is removed from the pedal for more than 5 seconds, brakes will apply at SERVICE rate. For further description see SAFETY CONTROL.

EMERGENCY SANDING

Emergency sanding (if installed) is applied in forward and reverse directions automatically during all emergency

brake applications, for a sufficient time to stop the train. In multiple-unit operation, emergency sanding is applied to all units regardless of whether they are equipped with pneumatic or electro-pneumatic sanding equipment.

LOCOMOTIVE OVERSPEED

When a locomotive equipped with overspeed protection exceeds the maximum permissible speed, an overspeed application is initiated.

1. The overspeed whistle blows.

2. In about 5 sec. a service brake application is made. Overspeed application can be suppressed according to railroad regulations.

PRESSURE AND TEMPERATURE GAGES

1. Control Air – Located in air brake compartment. Normal air pressure 70 psi.

2. Intake Manifold Air-pressure Gage – Located under engine control panel in operator's cab. (See Fig. 3.) Normal reading at FULL ENGINE SPEED and FULL LOAD is 16.5 to 21.0 psi.

3. Fuel Pressure Gage – Located under engine control panel in operator's cab. (See Fig. 3.) Normal fuel pressure at IDLE is 35 psi and at FULL LOAD is 25-30 psi.

4. Lube-oil Pressure Gage – Located under engine control panel in operator's cab. (See Fig. 3.) Normal lube pressure at IDLE is 20 psi and at FULL LOAD is 75-95 psi.

5. Water Temperature Gage – Located on right side of water storage tank. (See Fig. 7.) Normal operating temperature is 170-180 F.

OTHER GAGES

1. Engine Lubricating-oil Dip-stick – one located on each side of engine near lube-oil fill. The stick is marked HIGH and LOW (Fig. 16). Proper level with engine idling is between HIGH and LOW.

2. Fuel-oil Sight Glasses – mounted on both sides of the main fuel tank to indicate level of fuel in the tanks.

3. Cooling Water – a sight glass mounted on side of cooling water supply tank indicates level of cooling water in the system. Markings on tank indicate proper level for conditions. (See Fig. 7.)

WARNING: TO AVOID PERSONAL HARM FROM WATER BURNS NEVER REMOVE WATER FILL CAP WHEN WATER LEVEL IS ABOVE "FULL AT IDLE" MARK.

Fig. 10. (E-11826)

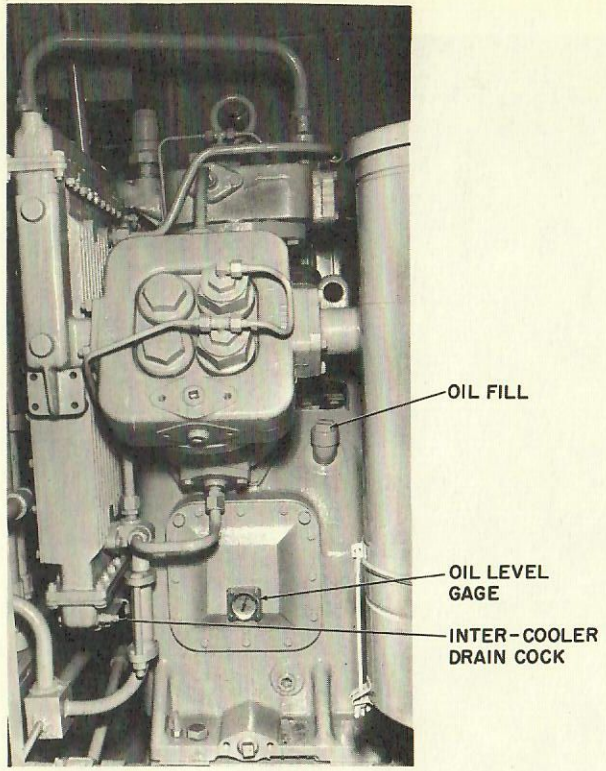


Fig. 10. Air compressor (WABCO)

4. Compressor Lube Oil (Gardner Denver Compressor – a gage mounted on the compressor frame indicates oil level. The gage scale is marked ADD (lower red scale), RUN (green scale), EXCESSIVE (upper red scale). (Westinghouse Compressor) Maintain to RUN level on oil level indicator gage. (See Fig. 10.)

5. Traction Generator Gear Box – has a dip-stick marked EMPTY – ADD – FULL. Proper level is between ADD and FULL with engine stopped. (See Fig. 11.)

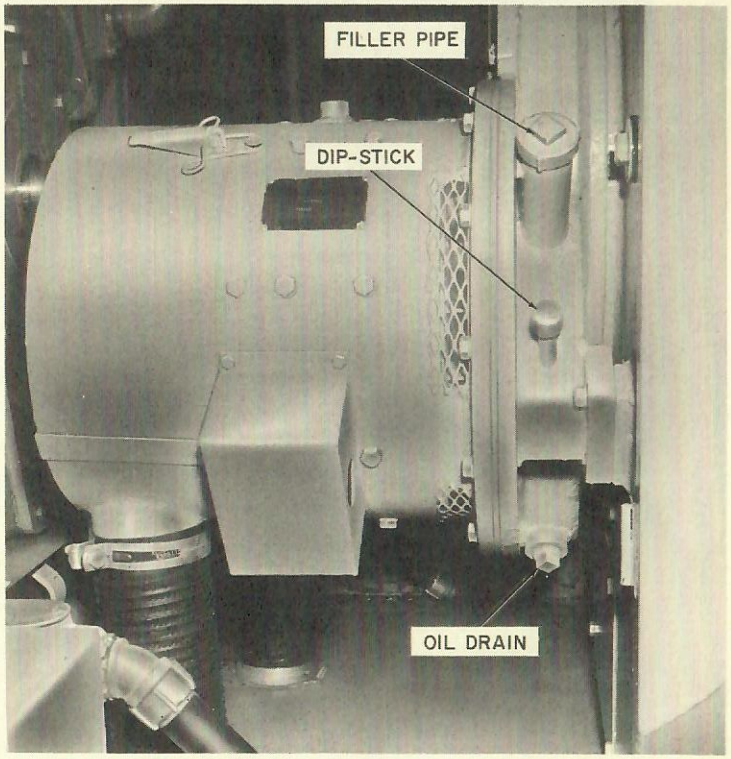


Fig. 11. (E-13029)

Fig. 11. Traction generator gear unit

6. Fan-gear-unit Oil Level Plug – maintain oil level near spill over. (See Fig. 12.)

7. Governor Oil-level Sight Glass – located on left side of engine near traction generator. (See Fig. 13.) Oil level must be visible between marks on sight glass when engine is running.

Fig. 12. (E-11827)

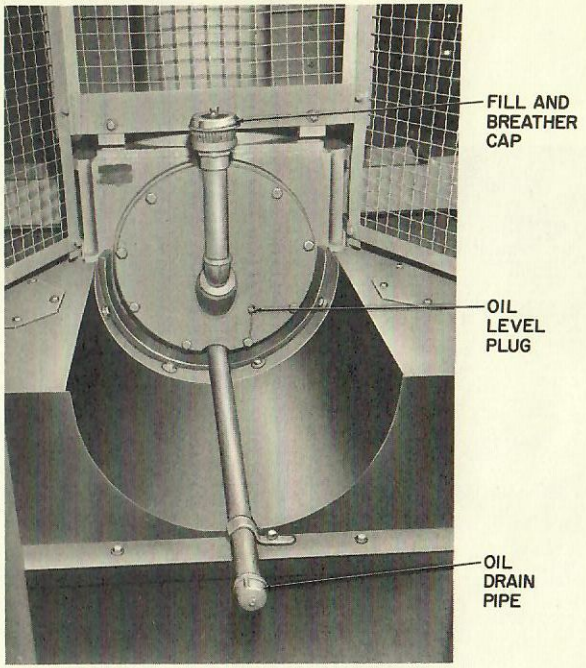


Fig. 12. Fan and blower unit service points

GAGES AND MEASURING DEVICES

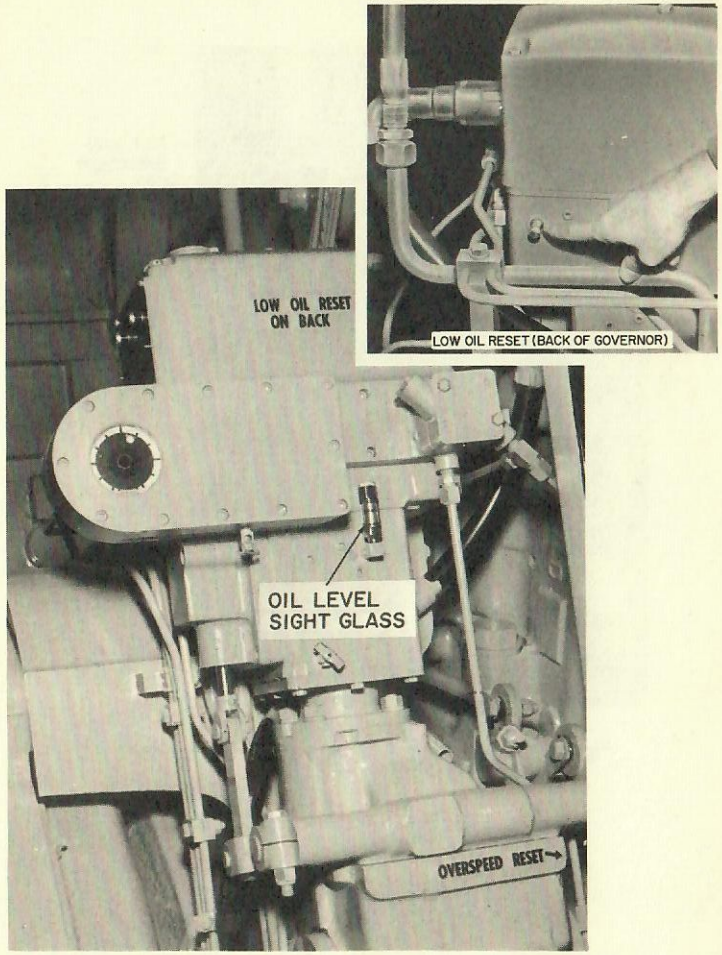


Fig. 13. (E-13030)

Fig. 13. Engine control governor and low oil reset

PREPARATION FOR OPERATION

The following checks and inspections should be made in accordance with railroad rules.

BEFORE BOARDING LOCOMOTIVE

1. Inspect for broken, worn, loose, or dragging parts (brake rigging, brake shoes, wheels, traction motor commutator covers, etc.).

2. Check for leaks from outside piping.

3. Properly position all drain and cut-out cocks.

4. Check proper connection of air hoses and jumper cables (if in multiple with other units).

5. Check fuel supply on fuel tank sight glass.

AFTER BOARDING LOCOMOTIVE

1. Remove rags, tools, etc., from moving parts and electric equipment.

2. Check diesel engine lubricating-oil supply. Oil level should indicate FULL on measuring gage with engine shut down. A measuring gage (dip-stick) is located on each side of engine and is marked LOW – FULL.

3. Check governor oil supply. Sight glass on governor should be full of oil. After engine is started, oil must be visible between marks on the sight glass. (See Fig. 13.)

4. Check air compressor lubricating oil supply. On Gardner-Denver, proper level is when pointer registers on green portion of scale of oil level indicator. Lower red scale indicates oil must be added. The upper red scale indicates excessive oil. (See Fig. 10.) On WABCO air compressor, maintain oil supply to RUN level on gage.

5. Check cooling water supply. Be sure that water drain valves are closed.

6. Check lubricating oil of generator gear unit. Dip stick is marked EMPTY – ADD – FULL. Proper level is between ADD and FULL marks. (See Fig. 11.)

7. Check that diesel-engine overspeed device is reset (Fig. 9).

8. Check that engine barring device is removed from engine.

9. Check that the following air cut-out cocks are open:

a. air compressor governor

b. control air

c. safety control (if used)

d. bell, horn and window wiper

e. overspeed control (if used)

10. Check that brake-pipe cut-out cock is "cut-in" (vertical position).

11. Brake valve cut-out cock (double heading cock) on 26L air brake system should be properly positioned.

12. The MU-2A valve must be positioned according to location of the unit in the locomotive consist.

13. Check positions of automatic and independent brake valve handles. Automatic brake valve handle should be removed on all trail units.

14. Move engine control switch to START.

15. Properly position MU headlight selector switch.

16. Properly position MU braking selector switch (if furnished).

17. Check that throttle handle is in IDLE, selector handle in OFF, and reverse handle in OFF.

18. Check that dead-engine cock is in LIVE (or closed) position.

STARTING ENGINE

1. Perform operations as in BEFORE BOARDING LOCOMOTIVE and AFTER BOARDING.

NOTE: IF THE ENGINE HAS BEEN STOPPED FOR A CONSIDERABLE PERIOD OF TIME, THE CYLINDERS SHOULD BE CLEARED OF FUEL OR WATER ACCUMULATION BEFORE STARTING THE ENGINE.

Proceed as follows:

a. Apply engine barring-over device and back off compression relief plugs on left side of each cylinder.

b. Rotate engine at least two complete revolutions by use of the engine barring-over device.

c. Remove barring-over device from engine and tighten all compression relief plugs before cranking.

2. Check that emergency stop switch is in RUN.

3. Check that ground relay indication pointer does not point to red dot. Check that cause of ground relay operation has been removed and then push reset button to reset relay.

4. Close battery switch located in front bulkhead of operator's cab.

5. Close the following circuit breakers on the engine control panel:

a. Control Circuit

NOTE: When starting engines of several locomotives in multiple unit consist, start engines one at a time. Close control circuit breaker only on one unit. Push fuel pump reset button and allow fuel pump to run a few seconds before starting engine. When all engines are running, close control circuit breaker on lead unit only.

b. Charging Circuit

c. Fuel Pump

d. Headlights

e. Running Lights

6. Push engine start button on engine control panel and hold until engine starts (approximately 25 sec.).

NOTE: IF PROPER ENGINE LUBE OIL PRESSURE DOES NOT BUILD UP WITHIN APPROXIMATELY 40 SECONDS, GOVERNOR WILL SHUT OFF FUEL AND PREVENT ENGINE FROM STARTING.

CAUTION: DO NOT DISCHARGE BATTERY EXCESSIVELY BY REPEATED ATTEMPTS TO START. IF FIRST TWO OR THREE TRIES ARE UNSUCCESSFUL, RECHECK STARTING PROCEDURE.

BEFORE MOVING LOCOMOTIVE

1. Turn engine control switch to RUN.

2. Make air brake test and other checks in accordance with railroad regulations.

3. Check main reservoir air pressure according to railroad rules.

4. Check control air pressure. Normal 70 psi.

5. Make independent air brake application. Release hand brake and remove any blocking of the wheels.

6. Allow time for engine cooling water to warm up before moving locomotive in accordance with railroad rules.

FASTER AIR PUMPING

To provide faster air pumping on locomotive, when reservoirs have been drained, or after locomotive has been coupled to a train, proceed as follows:

1. Leave generator-field circuit breaker in OFF position.

2. Close control breaker on engine control panel.

3. Leave reverse handle in OFF position.

4. Move selector handle to 1.

5. Move throttle handle to 4th or 5th notch as needed.

NOTE: If main reservoir air pressure is above 130 pounds and is not rising, increasing engine speed will not raise the pressure.

MOVING A TRAIN

1. Close generator field circuit breaker on master controller cover.

2. Move reverse handle to FORWARD or REVERSE position, depending on direction of movement desired.

3. Move selector handle to 1.

4. Place foot on safety control foot pedal (if used) and release brakes completely. Several minutes may be required to release brakes, depending on length of train.

5. Advance throttle handle.

6. The throttle handle has full notches and half notches (IDLE up to NOTCH 8), with each successive notch representing an increase in power, or locomotive tractive effort.

Starting a train depends on type, length, weight, grade, condition of rail, and amount of slack in train. This locomotive is designed to have easily-controlled tractive effort build-up characteristics, with the tractive effort in each notch limited to definite values as the throttle is moved from the lowest to the highest notch. No harm will be done by moving the throttle beyond notch 4 when starting a train. The engineman can easily control the amount of tractive effort required to start and accelerate a particular train. Speed can be controlled as desired by reducing or increasing throttle position.

STOPPING A TRAIN

Move throttle handle to IDLE and apply air brakes according to railroad regulations. If leaving operator's position after train has stopped move selector and reverse handles to OFF.

REVERSING LOCOMOTIVE

1. Bring locomotive to a full stop.

2. Move reverse handle to opposite direction.

3. Release brakes.

4. Open throttle.

PASSING THROUGH WATER

Do not exceed 2 or 3 mph if there is water over the rails. Do not pass through water that is over 2.5 in. above top of rail.

PASSING OVER RAILROAD CROSSINGS

Do not pass over railroad crossings at full power, or traction motor flashover may result. Reduce power by moving throttle handle to 5th notch, or below, while all units are passing over crossing.

WHEEL SLIP

When a slip occurs a light independent air brake application is made automatically. This may be observed by a fast flicker of the needle on the brake cylinder air gage. At the same time excitation is slightly reduced automatically. Most slips will be corrected by this automatic action.

If bad rail conditions cause the slip to exceed 3 sec. then sand is automatically applied to the rail. Wheel slip light will come on at about the same time sanding starts. When wheel slips cannot be controlled by braking and sanding, the excitation is reduced automatically.

If, in the engineman's judgement, the wheel slip is not corrected by the automatic control, it may be necessary

to reduce throttle position or apply sand, or both, until wheel slip is fully corrected.

NOTE: The slip suppression cut-out switch on the EC panel is normally sealed in the "UP" (closed) position. This switch should only be opened as directed by railroad regulations.

STOPPING ENGINES

1. Move throttle handle to IDLE.

2. Open GENERATOR FIELD circuit breaker on master controller stand.

3. Move engine control switch to START.

4. Press STOP button, on engine control panel.

5. To shut down all engines when in multiple-unit operation, move MU-ENG EMERGENCY SHUTDOWN SWITCH on master controller to STOP. EMERGENCY SHUTDOWN SWITCH must be in RUN before attempting to start engine.

BEFORE LEAVING LOCOMOTIVE

1. Apply hand brake and release air brakes after uncoupling from train.

2. Leave throttle in IDLE and selector in OFF. Remove reverse handle after moving to OFF.

3. Open all switches and circuit breakers.

4. Close windows and doors.

5. Open battery switch.

6. In freezing weather, precautions must be taken to see that the cooling water does not freeze. See DRAINING COOLING SYSTEM and follow railroad rules for this situation.

SAFETY CONTROL

Safety control (if installed) consists of a foot-pedal operated air valve, whistle and a cut-out cock. Except when the locomotive is stopped and locomotive brakes are applied, the engineman must keep the safety control foot pedal depressed at all times. This prevents safety control brake application.

After a penalty brake application has occurred, normal locomotive operation is restored in the following manner:

1. Move throttle handle to IDLE.

2. Move automatic brake valve handle to SUPPRESSION.

3. Depress safety control foot pedal. (See Fig. 1.)

4. After application pipe has built up to normal pressure, move automatic brake valve handle to RELEASE.

DYNAMIC BRAKING OPERATION

Dynamic braking is applied to the locomotive only. A dynamic brake interlock keeps the air brakes on the locomotive from being applied when automatic air braking and dynamic braking are being used. The MU braking selector switch (when installed), must be positioned according to railroad rules.

APPLYING DYNAMIC BRAKING

Applying dynamic braking is done in the following manner:

1. Move the throttle handle to IDLE.

2. Move the selector handle from 1 to OFF to B.

3. Advance the throttle handle slowly to bunch train slack. (Braking is now controlled by the throttle handle.)

4. After the slack is bunched, advance the throttle handle until the desired braking effort is obtained. Observe and correct braking effort during initial period of dynamic brake application.

CAUTION: DO NOT OPERATE IN 8TH NOTCH DYNAMIC BRAKING FOR MORE THAN 5 MINUTES AT SPEEDS ABOVE 61 MPH ON LOCOMOTIVES GEARED FOR A MAXIMUM SPEED OF 70 MPH, OR ABOVE 70 MPH ON LOCOMOTIVES GEARED FOR A MAXIMUM SPEED OF 80 MPH.

The amount of braking effort obtainable varies with the position of the throttle for the various speeds. Maximum braking effort is obtained in the 8th notch at approximately 22 mph on locomotives geared for 70 mph maximum speed, and at approximately 25 mph on locomotives geared for 80 mph maximum speed.

DYNAMIC BRAKING OPERATION

When a locomotive is equipped with variable range dynamic braking, a series of peak braking efforts will occur between 22.5 and 8 mph.

NOTE: Wheel-slip warning may occur while in dynamic braking. This indicates that wheels are sliding. Sand is applied automatically to the wheels of the sliding unit. Reduce throttle position until warning stops.

USE OF AIR BRAKES DURING DYNAMIC BRAKING

When necessary, the automatic air brake may be used in conjunction with the dynamic brake. Automatic air brakes will apply on the train but not on the locomotive. If the automatic air brake handle is moved to the emergency position, dynamic brake is removed and brakes on the locomotive as well as those on the train go into emergency application.

The independent air brake must not be used during dynamic braking to avoid flat spots on the locomotive wheels caused by sliding.

RELEASE OF DYNAMIC BRAKING

Release dynamic braking in the following manner:

1. Move the throttle handle to IDLE.

2. Move the selector handle from B to OFF to 1.

OPERATING AS LEADING UNIT

To operate the locomotive as a lead unit of a consist proceed as follows:

1. Make the necessary preliminary preparations for operation.

2. Test air brake in accordance with railroad rules.

3. Close the generator field circuit breaker.

4. Move reverse handle to the desired direction.

5. Move the selector handle to position 1. If any trailing units require manual transition then the selector handle for the trailing unit must be moved to positions 2, 3 and 4 at locomotive speeds required for transition on these units.

6. When equipped with M U Braking Selector Switch (optional equipment), position the Selector Switch according to railroad rules.

7. Operate locomotive in accordance with operating procedure.

OPERATING AS TRAILING UNIT

Air Equipment Set-up

1. Make a full service application with the automatic brake-valve handle.

2. Move the brake-valve cut-out (double heading cock) to the cut-out position.

3. Move the automatic brake-valve handle to the HANDLE OFF position and remove the handle.

4. Move the MU-2A valve to suit brake equipment on the leading unit (either TRAIL-24 or TRAIL-26 or 6 positions).

5. Place the independent handle in RELEASE position.

Electrical Set-up

1. Move the reverse handle to OFF and remove the handle.

2. Place the selector handle in OFF position. (Leaving the handle in position 1 of the trailing unit prevents loading when in multiple with some type locomotives).

3. Open the generator field circuit breaker on the master controller. Leave all breakers in the closed position on the engine control panel (EC) except the control circuit breaker. Running lights circuit breaker may be positioned as desired.

4. Place the M. U. headlight set-up switch in the proper position.

5. Place M. U. braking selector switch (if installed) in proper position.

CHANGING OPERATING ENDS

To change operating control from the cab of one locomotive unit to the cab of another proceed as follows:

Vacating Unit - Air Equipment Set-Up

1. Make a full service brake pipe reduction.

2. Allow time for all air blowing sounds to stop then depress the handle of the brake valve cut-out cock and move it to the CUT-OUT position.

3. Place the automatic brake-valve handle in the HANDLE-OFF position and remove; place the independent brake-valve handle in the RELEASE position.

4. Depress the handle on the MU-2A valve and move it to TRAIL-24 position or TRAIL-6 or 26 position, depending on the type of equipment used on the lead locomotive unit.

MULTIPLE UNIT OPERATION

Vacating Unit — Electrical Set-up

1. Move the reverse handle to OFF and remove the handle.

2. Place the selector handle in OFF position.

3. Open the generator field circuit breaker on the master controller.

4. Leave all breakers in the closed position on the engine control panel (EC) except the control circuit breaker. Running Lights Circuit Breaker may be positioned as desired.

5. Move M. U. headlight set-up switch to required position.

Operating Unit – Air Equipment Set-up

1. Insert the automatic brake valve handle in the HANDLE-OFF position.

2. Move the independent brake-valve handle to the full application position.

3. Depress the handle of the MU-2A valve and move it to the LEAD or DEAD position.

4. Depress the handle of the brake-valve cut-out cock and move it to the CUT-IN position as required by the service in which the locomotive is to be operated.

Operating Unit – Electrical Set-up

1. Insert the reverse handle into the reverser of the master controller.

2. Close the generator field circuit breaker on the master controller.

3. Close all circuit breakers on the engine control panel (EC).

4. Move M.U. headlight set-up switch to required position.

MULTIPLE UNIT OPERATION

TO OPERATE WITH OTHER TYPES OF UNITS

If the units of the locomotive consist are geared for differing maximum speeds, do not run at speeds in excess of that recommended for the unit having the lowest maximum permissible speed.

Similarly, do not operate at low speeds long enough to exceed the specified traction motor ratings on any of the units in the locomotive consist. The U25 locomotive, because of its high horsepower per axle, will develop more tractive effort at any given speed than will units of lower horsepower per axle.

On U25 units equipped with automatic power matching control, power is automatically reduced to a lower level under certain conditions when operating at low locomotive speeds. Special operating instructions will be required for this feature.

When the leading unit is slipping excessively the power limit switch can be moved to notch 7 to reduce the power on this unit while the trailing units are operating at full power. This will reduce the tractive effort on the leading unit and will usually improve the ability of the locomotive to hold the rail under bad rail conditions.

Units equipped with braking current limiting regulators can be operated in multiple with U25 locomotives in dynamic braking, regardless of the gear ratio or differences in maximum braking current ratings. If some units do not have current limiting regulators, the locomotive consist MUST always be operated so as not to exceed the braking current of the unit have the lowest maximum braking current rating. Special operating instructions will be required for this case.

When a locomotive unit with 26-L equipment is operated in multiple (lead or trailing) with 24-RL equipped units, or with units equipped with brakes of the No. 6 type, the following hose connections must be made:

26-L		24-RL		OR WITH NO. 6
Brake Pipe		Brake Pipe	to	Brake Pipe
M.R. Equalizing Pipe	to	M.R. Equalizing Pipe	to	M.R. Equalizing Pipe
Actuating Pipe	to	Actuating Pipe		
B.C. Equalizing Pipe	to	Ind. Appl. & Rel. Pipe	to	B.C. Equalizing Pipe
Sanding Pipe	to	Sanding Pipe	to	Sanding Pipe

26-L and 24-RL equipped locomotive units can be operated together in any combination.

26-L and No. 6 equipped locomotive units can be operated together in any combination.

With 26-L equipped locomotive leading one or more 24-RL equipped locomotive units, No. 6 equipped units with or without actuating pipe can trail.

Only if it has an actuating pipe, can a unit having No. 6 type equipment be operated between a leading 26-L equipped unit and a trailing 24-RL or 26-L equipped unit.

BRAKE PIPE LEAKAGE TEST

A brake pipe leakage test can be performed in the following manner:

With the brake system fully charged and with the brake valve cut-out cock in CUT-IN position, move the automatic brake valve handle promptly toward service position until the equalizing reservoir pressure has been reduced 15 psi, then stop and leave the handle in this position.

As soon as the brake-pipe pressure has reduced to the level of the equalizing reservoir pressure (continuous blow from brake-valve exhaust), depress the brake valve cut-out cock handle and move it to CUT-OUT position. Immediately observe the brake-pipe gage and time the pressure drop in accordance with railroad rules.

At the completion of the brake-pipe leakage test, move the brake-valve handle further toward SERVICE position and reduce the equalizing reservoir pressure slightly below the brake pipe pressure. The brake may later be released by returning the brake valve handle to RELEASE position.

DEAD HEADING

1. Place the independent brake-valve handle in RELEASE position and the automatic brake-valve handle in HANDLE-OFF position.

2. Depress the brake valve cut-out cock handle and move to CUT-OUT position.

3. Depress the handle of the MU-2A valve and move to LEAD or DEAD position.

4. Open the dead engine cock.

DRAINING WATER SYSTEM

For weather above freezing the cooling water system may be drained by opening the main water drain valve on the right side of the locomotive near the base of the lube oil cooler. (See Fig. 14.)

For freezing weather, in addition to opening the main drain valve, remove the plug at the base of the water pump and be sure that both cab heater valves are open.

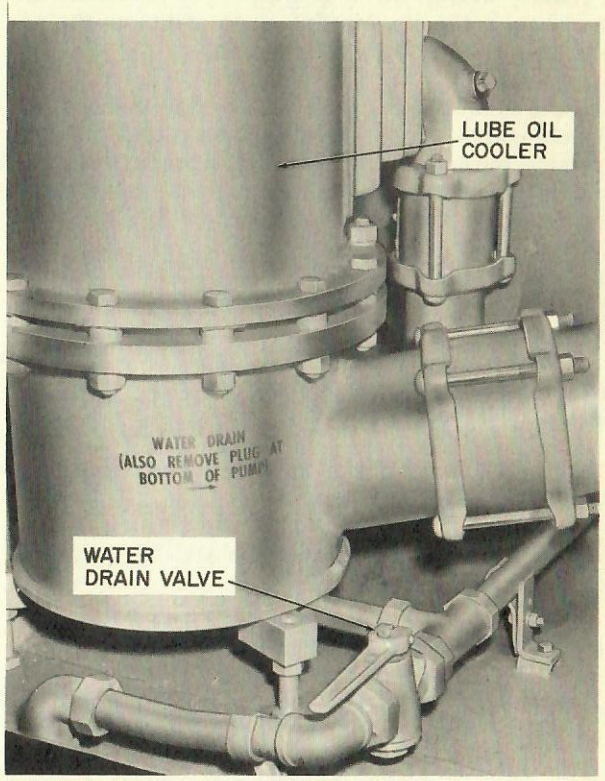


Fig. 14. Water system drain

Fig. 14. (E-11829)

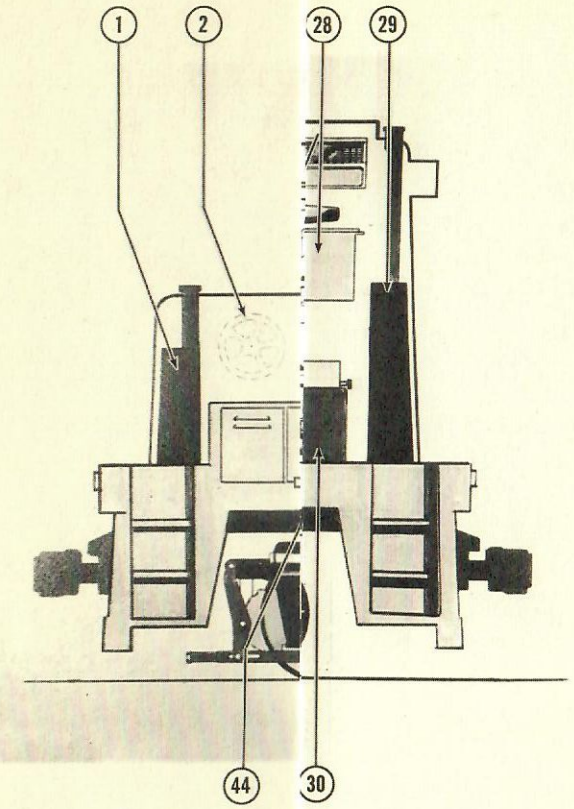
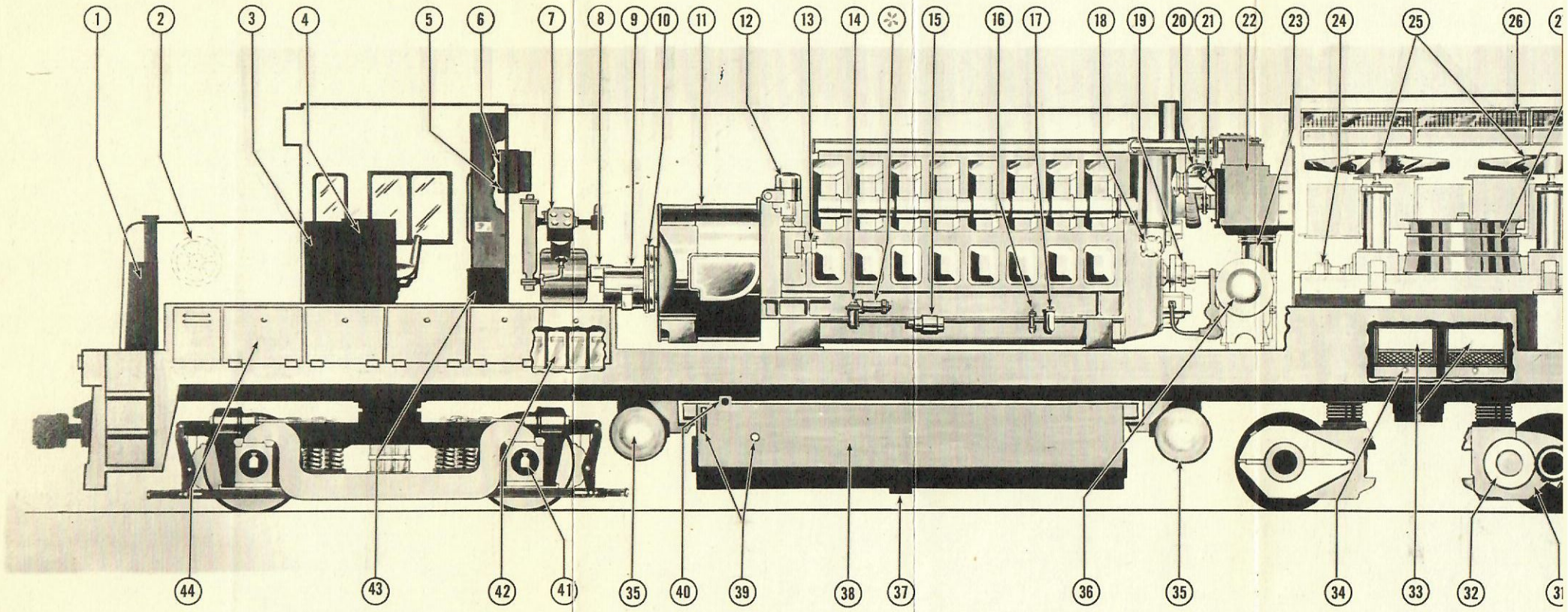


Fig. 15. (E-11830)

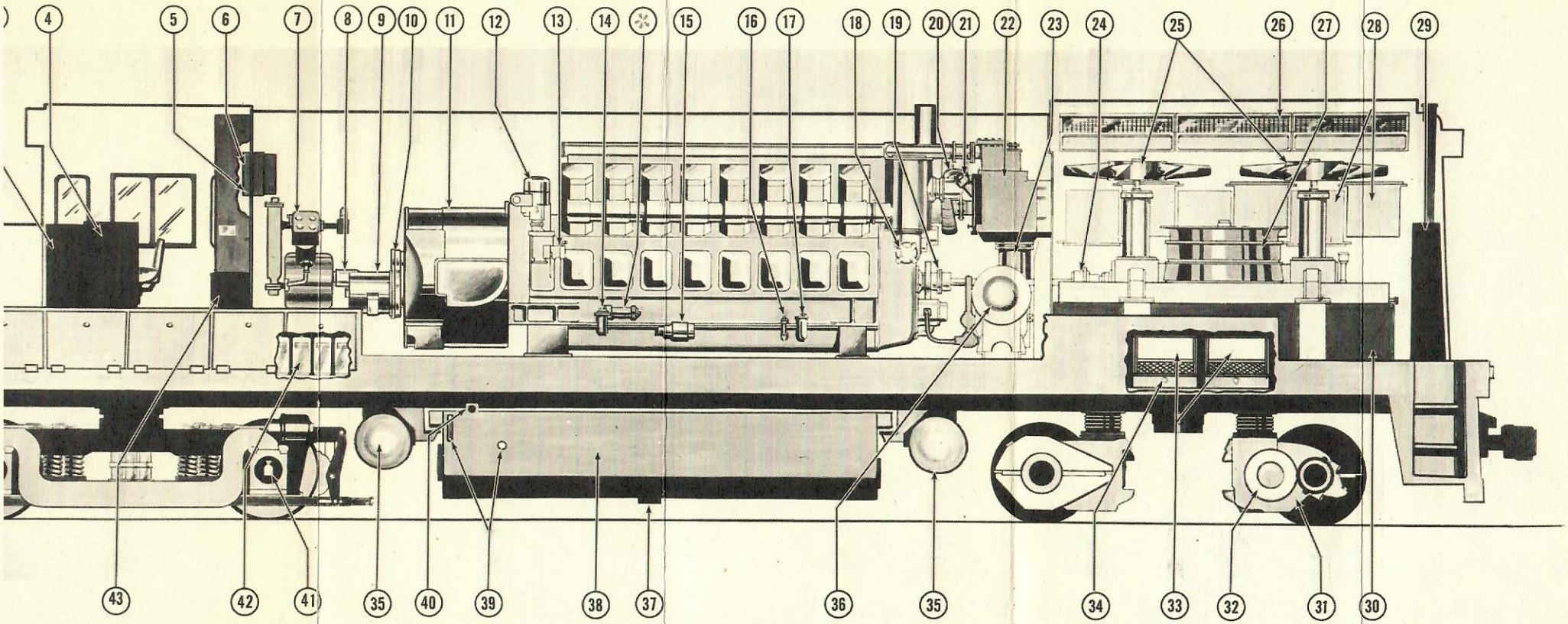
Fig. 15. (E-11830)



1 Sand box
2 Handbrake
3 Operating controls and gage panel
4 Air brake controls
5 Emergency fuel cut-off button
6 Engine control panel
7 Air compressor
8 Flexible coupling
9 Auxiliary generator (left side)
Exciter (right side)
10 Traction generator gear case
11 Traction generator
12 Engine control governor
13 Overspeed governor
14 Fuel strainer
15 Fuel booster pump
16 Lube oil dip-stick (both sides)
17 Lube oil filler
18 Lube oil strainer
19 Flexible coupling
20 Turbocharger
21 Water fill (pressurized)
22 Water storage tank
23 Lube oil cooler
24 Flexible coupling
25 Radiator fans
26 Radiator
27 Equipment blower
28 Braking resistors
29 Sand box
30 Primary air cleaner
31 Traction motor gear case
32 Traction motor
33 Engine air filters
34 Air filter oil level
35 Main air reservoir
36 Lube oil filter
37 Fuel tank sump
38 Fuel tank
39 Fuel level gages
40 Fuel tank fill (both sides)
41 Axle alternator (all axles)
42 Batteries (right side)
43 Cab heater
44 Control compartment (left side)
Air brake compartment (right s

* Fuel heater (optional)

Fig. 15. Apparatus l



1 Sand box
2 Handbrake
3 Operating controls and gage panel
4 Air brake controls
5 Emergency fuel cut-off button
6 Engine control panel
7 Air compressor
8 Flexible coupling
9 Auxiliary generator (left side)
Exciter (right side)
10 Traction generator gear case
11 Traction generator

* Fuel heater (optional)

12 Engine control governor
13 Overspeed governor
14 Fuel strainer
15 Fuel booster pump
16 Lube oil dip-stick (both sides)
17 Lube oil filler
18 Lube oil strainer
19 Flexible coupling
20 Turbocharger
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39 Fuel level gages
40 Fuel tank fill (both sides)
41 Axle alternator (all axles)
42 Batteries (right side)
43 Cab heater
44 Control compartment (left side)
Air brake compartment (right side)

Fig. 15. Apparatus location

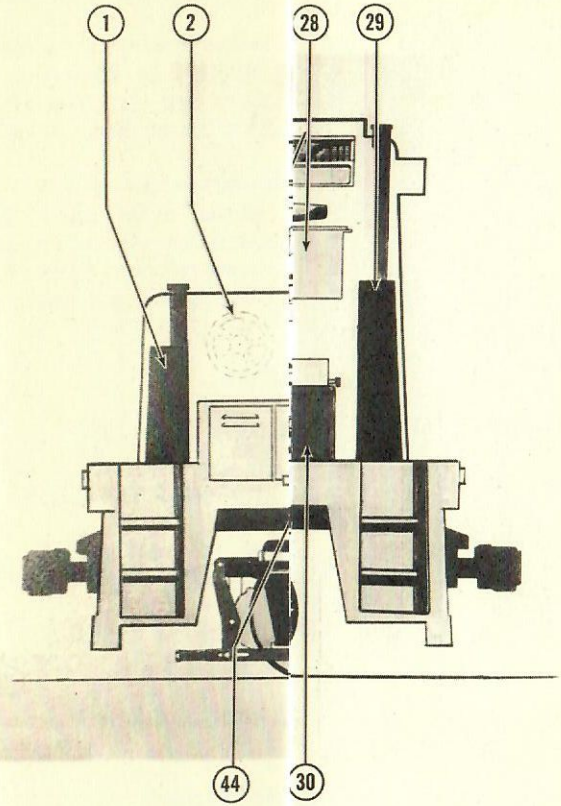

Fig. 15. (E-11830)